99-118
426-417
1935
72

...BLE RENDERING

By

Dr. C. Robert Moulton

PAPER NO.
JUN 7 1937
DIVISION 63

Published by Meat Magazine • Chicago
Original Article Published October, 1935

FOREWORD

In a properly run packinghouse the rendering of edible fats is kept entirely separated from the inedible part of the business. But, in spite of the fact that inedible fats are not as good as edible fats, much can be done to keep down the quantity of material necessary to handle as inedible. Rigid inspection of raw, inedible tissues will help to keep the quantity low, and to prevent the inclusion of foreign matter that causes a poorer rendered fat.

Inedible fats may be rendered by either the wet or the dry rendering process. The latter process is much in favor, especially where bone is included. A newer method, known as the circulating rendering process, was originally designed for the handling of inedible products. This process, having many advantages for both inedible rendering and the rendering of edible fats, is discussed in detail.

Finally, this booklet discusses the testing of the finished rendered fat, and gives standards such fats should meet.

C. Robert Moulton

INEDIBLE RENDERING

Both large and small operators will profit from a careful consideration of the methods which may improve their product. As a rule the small operator will produce but the one product called lard while the larger operator may produce different lards from killing and cutting fats and may also make kettle rendered lard and neutral lard.

The packer, large or small, that handles cattle, calves, and sheep in addition to hogs will have beef and mutton fats to handle. What he does with them will depend upon the relative quantities of the different raw materials he handles and also upon the total amount of non-lard producing fatty tissues he produces. A large producer will usually render his oleo stock separately and will produce both oleo oil and oleo stearine. He may then use these and his neutral lard and vegetable oils in the production of margarine and shortening compounds. He may also produce edible tallow and may put the beef and mutton into separate products. A smaller producer may make only edible tallow.

Since relatively few of the total number of meat packers make the above named fatty products with the exception of lard, details of the handling of these products will not be taken up at this time.

Inedible Products

The packer has a number of inedible fat products just as he has several edible products. A large producer may make grease out of inedible hog fats, and from cattle, calves, and sheep he may produce inedible beef and mutton tallow, neatsfoot oil, neatsfoot stearine, tallow oil, and tallow stearine. In case the amount of raw materials does not warrant this diversity of product the packer may make only inedible tallow and grease, or he may find it necessary to produce but one product out of all of his inedible fatty tissues. Thus inedible materials from cattle, hogs, calves, and sheep may all go to inedible fat. This fat may be called grease if hog fats predominate, while it may be called tallow when beef and mutton fats are in the majority. At any rate no deception is intended and no deception is practiced since the purchaser buys on specification or physical properties and he knows the type of products that are produced by the plants with which he does business.

The relative proportion of inedible fatty tissues produced from hog carcasses is generally small. There will be the discarded materials from bruises, shackle bruises, broken backs, twisted socket joints, jaws, skulls, snouts, and jaw bones which the packer finds it does not pay him to prepare for use in lard. In addition there will be fatty tissues which have been contaminated and various miscellaneous parts where it is not practical to separate the fatty tissue from the lean. But the majority of material from the hog that goes into inedible product comes from condemned parts of animals.

In the case of cattle, calves and sheep there is a greater proportion of fat-yielding tissues in addition to condemned materials which may normally find their way into inedible products. Estimation shows that on the average the beef department produces about 80 pounds of raw material per animal, the calf department about 15 pounds per animal, and the sheep department about 8 pounds per animal which goes to the inedible rendering department.

Besides condemned tissues and animals, other parts of the beef animal and sheep will go to the inedible rendering department. Inedible tallow is made from: Meats where it is impractical to separate the fatty tissues from other tissues for use in the edible product, for example, tongue trimmings and head bones; casing machine fat; bone washer jelly; rennets; windpipes; tonsils; hide trimmings; casing ends; melts; pauch trimmings; lungs; slunks; cowbags; beef bruises; oleo vat sinkers; pecks; tripe; catch basin skimmings, and floor sweepings. Such materials as catch basin skimmings, had better go to a low grade grease for they certainly lower the grade of inedible tallow or grease.

Proper Handling Important

It may seem like drawing a fine line with an inedible product to state that even here it is important to render the raw materials promptly after slaughter in the case of all materials excepting the catch basin skimmings. The first aim of the inedible rendering department should be to produce as little as possible of inedible fats, for this means that as much as possible is going into edible products. Much can be done by proper handling to keep up the relative amount of edible fat and to keep down that of inedible fat. The second aim is to render all raw materials promptly.

The previous articles on lard have told about the enzymes in fatty tissues which cause free fatty acids. They have also told about the deteriorating effect of tissue, moisture, blood and warm temperatures. Bacteria will grow rapidly in all meats and meat products including fatty tissues that are not promptly disposed of or quickly chilled and kept cold until ready for use. These articles have also stated that iron rust, copper or other metal will help speed up rancidity. So will exposure to light and air. Free fatty acids, rancidity and sourness, putridity and moldiness due to bacteria, yeasts and molds materially lower the grade of the fat and decrease the price the renderer can get for it. In the present state of relative shortage of meat animals and animal fats it will pay the packer to save all he can and to keep it in as high a grade as he can. This applies to inedible product as well as to to the edible fats.

Likewise during rendering extreme heat and pressure tend to scorch the fat and to bring about decomposition. The retention of any moisture, tissue or other impurities after rendering continues the process of deterioration.

Quick handling and proper processing are important not only on account of the better fat that is produced but also on account of the savings made on the tankage or cracklings. Whenever bacteria, yeasts, and molds get a start on animal tissues they soon attack the protein and lower the nitrogen or ammonia content of tankage or cracklings. This means a loss of money to the renderer.

In the establishment of an inedible rendering department it must be borne in mind that the department as a whole and all of its machinery and equipment must be completely separated from edible rendering departments. They should be located in separate buildings or if this is impractical, arranged so that no doors communicate between the departments. These precautions are necessary in order to prevent some thoughtless or careless operator making a mistake in the disposition of the materials.

Rendering Processes

In the rendering of inedible products all of the various methods may be used including wet rendering, dry rendering, and circulating rendering. Some of these

methods have advantages over others, and there is always the question for a renderer to answer: "Shall I buy this new or additional equipment in order to make use of its advantages, and will it pay me to do so?" Too often, it seems, he decides in favor of original saving in cost as against final profits via better products.

No matter what rendering process is used, *all* raw materials should be hashed and washed to remove any foreign matter and contamination. There are on the market good mechanically operated gut hashers and cylindrical washers which do a good job. But even if the plant is too small to own such a device, the hashing and washing can at least be done by hand. In the case of whole carcasses or other raw material containing much bone a crusher known as a "Hog" is most favored for disintegrating the bone. Such a device must be used in the circulating rendering process. Many small plants, however, do not want to shoulder the expense of a crusher for only about one hour's work daily. In some ways this is too bad for that process has some advantages that are often worth getting.

Inspection of Raw Materials

In addition to hashing and washing, raw materials for rendering should be carefully inspected for fourteen points. Proper attention to these will generally pay for the time and trouble in money saved by the packer or renderer.

1. Check the cleanliness of the product to be sure the washing is accomplishing its purpose.
2. Note carefully whether all edible fatty tissues have been removed.
3. See whether the classifying as inedible has been due to spoilage from careless handling.
4. Determine from the appearance and odor whether such materials as catch basin skimmings are being handled as promptly as possible.
5. Check to see that the cutting department has removed all meat possible from the bones.
6. See that all fat suitable for oleo stock (if you make oleo) is removed from pecks, paunches, lungs and windpipes.
7. If your best paunches are used for edible tripe, note whether the tripe coming to the inedible department includes any that is suitable for edible purposes.
8. If slunk skins are being saved, see that they have been removed from the slunks.
9. If you make oleo see whether the oleo bottoms have soured from careless handling. Also see that no good free oleo stock is in these bottoms
10. Watch the floor sweepings to see whether they contain material fit for edible products but which has been carelessly dropped on the floor.
11. Look at the catch basin skimmings to see that their condition, contents, and amount show sufficiently frequent skimming and prompt delivery to the rendering department. There should be no clear rendered fat or raw edible product present. There should be no unusual or excessive amount from any one department of the plant.
12. Note whether the proportion of condemned material is unusually large.

13. Watch for manure, paunch contents and other such contaminants. When cooked with fatty tissues these cause a darkening and decomposition of the rendered fat. They frequently cause an objectionable green color in the tallow. They consume steam power during rendering, pressing, drying and evaporating. Last but not least they soak up 7 to 10 percent of their weight of rendered fat. So *do not tank* any non-fat-yielding materials.
14. Material intended for the melters rather than the tank should be inspected for pieces of iron or steel which are apt to get wedged in the melter, or bend or break an agitator arm thus stalling the machinery or burning out a motor. They may, if they get by the melter, wedge or damage an expellor or break a filter cloth. Finally if they get into the grinder they may damage it.

Wet Rendering

General operation of the steam rendering process has been described in the articles on lard. The process when used for inedible products does not in any way differ from that for edible products. Of course, the equipment and rooms must be separate and distinct, and this means a complete set of apparatus for inedible rendering. The high temperature employed in the steam rendering operation may do less relative damage in the case of inedible fats, yet on the whole the presence of much moisture and tissue together with the high temperature does help to lower the quality of the inedible fats. Since as a rule large charges are required in wet rendering there is always the urge to keep some of the raw materials longer than they should be kept. Dry rendering is replacing wet rendering more and more in the inedible departments since it makes it easy to process the materials when fresh.

Dry Rendering

The general preparation of the raw materials for dry rendering is the same as for wet rendering, but many operators crush any and all of their raw materials which contain bone in large pieces. Uniformly small pieces means quicker rendering and less strain on the agitating mechanism. The so-called "Hog" crusher, which is most favored, consists of a drum to which are attached blades which shear against stationary blades thus cutting the material that is fed in. For the proper operation of this crusher a large sized motor is needed, also good foundations and good wiring. The entire cost rather encourages small renderers to try operating without the crusher.

The melter of the dry rendering plant may be a horizontal, cylindrical steam jacketed kettle with a many bladed agitator. There is an opening in the top near one end for charging and a discharge door in the center bottom of the opposite end. Heavy paddles are fastened to arms which are carried on the rotating shaft. The inner shell of the melter is smooth so that the paddle can scrape fairly close to the surface at all points. Yet it is not machined and special attention must be given to preventing sticking of the product. The inclusion of bone in the raw materials is a help in this respect. The shaft must be supported on heavy bearings with good packing so no melted product may leak out. Also the arms and paddles must be so fastened that they never come loose. The stirring of the materials pre-

vents scorching, helps get rid of water and gas more readily, and enables the heat to have access to all of the raw materials.

Some horizontal melters have the ends built to withstand internal pressure. They must have thermometers and pressure gauges to indicate conditions within the melter and to aid in avoiding scorching. There should also be a trap to remove the condensate which comes from the cooking.

A galvanized iron stack conveys the moisture and vapors to the outside. Some operators connect the outlet to a condensor or vacuum pump and are thus able to operate in the absence of air or even under a vacuum, which permits the use of a lower temperature and gives a better grade of rendered fat. In either case odors are reduced so that complaints are easily avoided.

Motors of proper and adequate size must be used in order to avoid frequent shut-downs and the scorched tallow that may result. A shut-down also allows the inside of the inner shell to be coated with coagulated gluey material which not only prevents good heat transfer and so delays the cooking, but also may easily lead to scorching.

Vertical melters are preferred by some operators. Their construction and operation are in general the same as for the horizontal melters. However, they are steam jacketed on the bottom and the lower half only of the sides. The agitators, of course are fastened to a vertical shaft.

In the cooking operation it is best to start with a priming charge of fat such as the expressed fat from the cracklings. The agitator is then started and the melter is loaded, after which the steam is turned on and the cook proceeds as rapidly as possible. When the contents of the melter are cooked the discharge valve is opened and the material is dumped rapidly into a tank or hopper with a false bottom which allows the rendered fat to drain off. The solid material then goes to an expellor or press.

It is important to know when the material is sufficiently cooked. Appearance is an aid and so is a thermometer which gives the temperature of the material in the melter or of the vapors above it. The steam should be shut off shortly before the cook is completed and the steam jacket should be drained. The cook then completes itself by means of the heat already present. Of course if it is ever necessary to stop on account of failing agitation or other cause the steam should be shut off and the pressure should be vented in order to prevent scorching. Proper cooking is aided by a constantly uniform charge. Materials high in fat and low in water cook faster than those low in fat and high in water. Bones are low in fat and water and have a different cooking time than other tissues, and they must either be crushed or disintegrated in the cooking. For these reasons it is best to keep fairly constant proportions of bones, high fat materials, and low fat materials. The fat or grease is very important here for it helps carry the heat into the charge, and herein lies the value of the priming charge especially when the materials to be rendered are low in fat.

Operators who do not crush their bone stock must make use of internal pressure in the melter in order to disintegrate the bone. Others who use this process crush the bone since it saves time. The operation is started with an open vapor line till the first gases are expelled. Then this line is closed and the melter sealed up tight so that the water in the materials in the melter will give an internal steam pressure. This disintegrates the bone and meat and rup-

tures the fat cells. After the cooking has proceeded long enough to do the disintegrating, the vent line is opened and the pressure and steam vapor is allowed to escape. One must be careful of foaming or the escape of valuable material through the vent when relieving the pressure. The process is completed by dry cooking under a partial vacuum.

Circulating Rendering

A system of rendering known as the circulating rendering system is becoming quite popular on account of the fact that it is economical and efficient and permits the use of low steam pressure or exhaust steam. It can be used for any kind of product but bone stock must be crushed. Since this requires a crusher, some small renderers do not use this system, and this is too bad since there are savings in the consumption of steam and a lessened chance of scorching the fatty tissues when the circulating rendering system is used. While this system originated with inedible rendering it is spreading to edible rendering and may soon be more widely used in edible departments.

In the circulating rendering system there is a tubular heating element with vertical tubes through which the material to be rendered passes. The outside of the tubes is heated by exhaust steam at gauge pressure below five pounds. In the larger units a centrifugal pump of the non-clogging, impeller type draws the material from the bottom and discharges it at a point above the top of the tubes. Above this heating chamber is a flash chamber for the release of the vapors which go through a separator to a barometric condenser. A two-stage steam ejector is connected to the barometric condenser to produce a vacuum.

The material intended for this rendering system is ground and conveyed to a steam jacketed mixing and charging tank with an agitator where it is heated before pumping into the tubular heater and flash chamber. A priming charge of fat may or may not be used depending on the relative fat and water content of the materials. The circulation of the materials is continued until rendered when they are sent to a settling tank and the cracklings are put through a press or expeller.

In small units of 3,000 to 6,000 pounds capacity the circulation is accomplished by means of a rotating spiral within the specially designed heating element. The outer shell, webs, and inner cylinder of this heating element are all steam-jacketed. Thus both maximum heating surface and maximum heat transfer are secured.

The advantages of the circulating system are several. It is economical, since exhaust steam is used. A quality product is produced, since the low steam pressure gives a low temperature with no danger of scorching. The use of heat is efficient on account of the excellent heat transfer obtained. The rendering is rapid due to the circulation.

In all cases the rendered materials must be well drained and the cracklings must be pressed in an expeller or hydraulic press. The fat so removed is put back with the next batch to be cooked since it contains much fine material which will be largely removed in the second cooking.

The fat is more difficult to clarify and settle than in the case of wet rendering because of the presence of some gluey matter which presses out of the cracklings. Cooking the cracklings till they are well dried out will prevent this. It is generally customary however, to boil the fat with salt water and then to settle it, or else to filter it through the

filter cloths that are usually employed. Other filtering aids—fuller's earth, diatomaceous earth, or specially prepared charcoal and filter cell—are not usually necessary, are an expense, and cause a loss of some fat.

Testing the Product

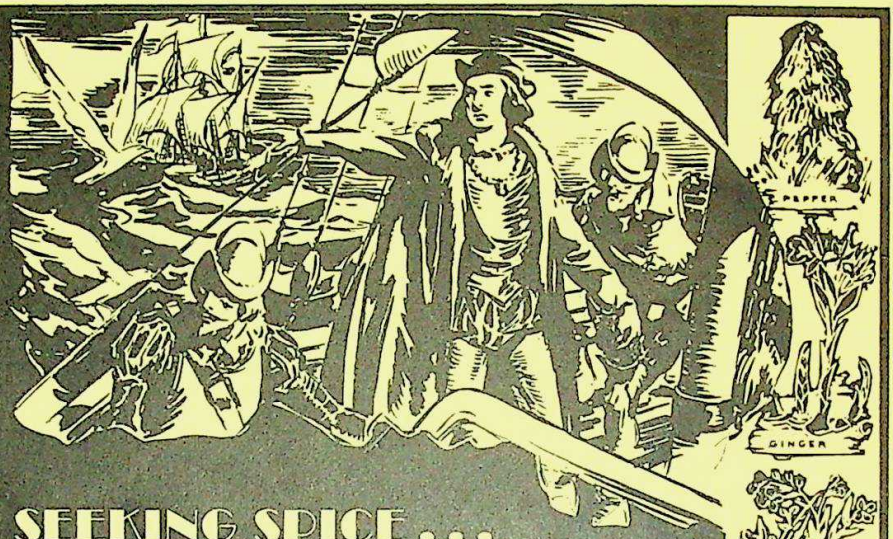
It pays to carefully examine the rendered fat for the presence of free fatty acids, rancidity, other off flavors and odors and color since all of these reduce the quality of the inedible fat and decrease the price that can be obtained. In the present state of comparative shortage of animal fats it will pay to render and handle inedible fats properly. The testing of the finished product will help the operator to check on the selection and handling of the raw materials and the process of rendering.

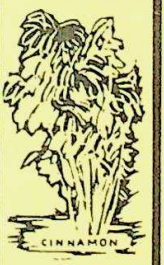
The hardness of the finished product will depend on the fatty tissues used. As a rule a tallow has a titer or hardness ranging from 40° to 45° C. The inclusion of softer beef fats and of hog fats will decrease the temperature. Experimental rendering of all types of stock shows that very few of them when handled promptly will yield a rendered fat of over 2 percent of free fatty acids. Therefore any more free fatty acids than the 2 percent in your final product shows bad handling. Much catch basin skimmings or badly handled oleo stock run up the acid content.

The color of the fat depends on the nature of the materials rendered, their cleanliness and freedom from blood and other contaminating material, and the control of temperature in all dry rendering processes. The color is readily determined by means of a tintometer and Loviband glasses. But a better way is to use the standard tubes recommended by the American Oil Chemists Society. These are aniline dyes dissolved in glycerine and put into tubes which make comparison with the liquid fat easy.

In case bleaching is contemplated a sample should be heated with four percent of a standard fuller's earth to see what the effect will be.

Moisture, impurities and unsaponifiable matters are also usually determined. The impurities may be due to incomplete settling, to dissolved soaps resulting from a combining of bone with oil, any bleaching agent used, or lubricating oils that may get into the product.





SEEKING SPICE . . . HE FOUND A NEW WORLD!

SPICE was the most valuable article of ancient commerce. It was the desire to find a safer, shorter route to the spice lands of the East that launched Columbus on his epoch-making journey to the West.

Modern transportation and improved processing has greatly reduced the *cost* of spice. But lower cost has in no way lessened the *value* of genuine spices as a powerful sales stimulant for meat specialties.

No fantastic or exaggerated claims have ever played a part in the sale of Mayer Special Seasonings. We undertake merely to bring you the world's finest natural spices, expertly refined, ground and blended. Our representative will gladly demonstrate in your own plant the benefits that Mayer Special Seasonings can bring you.

H. J. Mayer and SONS CO.

6819-27 South Ashland Avenue: Chicago, Illinois
Canadian Plant: Windsor, Ontario

Manufacturer's of NEVERFAIL-The World's Perfect Cure